

THE CHALLENGES OF BUSINESS INTELLIGENCE IN THE MANAGEMENT OF COMPANIES

THE ROLE OF 3.M SYNDROME OF ACCOUNTING SYSTEMS IN BUSINESS INTELLIGENCE

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Abstract

The content of this paper can be summarized as follows: every enterprise has at least a few unique features in its own accounting information system, as well as in its management support system. On the other hand, general ERP (Enterprise Resource Planning) systems are not designed to support these unique accounting features of firms. These features are basic of the Business Intelligence of the firm, and mainly found in the decision-support part of information system, and are determined by the data model of the information system.

Furthermore, managers continuously have to develop their decision-support information systems. Contribution to the literature: there are always three data-models present when designing application development schemes for accounting information systems: the data model for the new information system defined by long-term strategic goals, the data processing model used so far, and furthermore, the data model of the bought or adopted information system. As such, one must be very careful when changing the accounting information system of one's firm.

1. Introduction: motivation and subject of the research

What are the challenges that managers of industrial, agricultural, and service companies have to face when developing their information systems? Can an ERP system meet all the information demand of the Managers? Having researched management information systems (MIS) for 28 years and knowing the accounting information system of 24 firms, I can say that there are some problems with the matter at hand. The root of the problem is that it is always the specialties of an information system that are the most important from a management viewpoint.

To carry out their management tasks, managers need a lot of information, for example about the company's assets, capital, cash flow, resource utilization, financial situation, and so on. The following table presents some details from the research that are useful for understanding the similar and different information needs of the management in case of different business entities in Hungary, Table 1:

The meaning of the colour-codes in Table 1 is as follows:

1.1 The 4th column (headed AIT-1) indicates the basic method of bookkeeping and preparing the annual reports of the firm. There are only two cases in this column: bookkeeping by outsourcing or by an in-house ERP system (AIT stands for Accounting Information Technology).

1.2 In the 5th column, AIT-2: this column shows the most important parts of the companies' ERP systems, which are related to the areas that determine the firms' success. The 24 companies can be put into 5 categories. It is worth noting that if the firm does not have any ERP system, then it does separate booking for its substantial data.

1.3 The 6th column is AIT-3, which contains the most important information requests of the management (at the moment). This information request is the *unique and special demand of the management*. Even if the firm has its own ERP system, it will still carry out (detailed, analytical) manual accounting separately. Different execution of special accounting problems could be found at each of the 24 firms. This was the reason for marking the cells of AIT-3 column with different shades.

The following 3 examples can help to understand case 1.3 above:

1.4 "BH" – Industrial services in the 19th row of table 1:

This firm has no material costs but has about a dozen special machines that are used for the maintenance of oil industry equipment. These machines are used intermittently, and therefore careful accounting of their operation is required to adequately track amortization costs. We came to the decision of preparing separate accounting reports on machine capacity usage (on top of what is included in the ERP) in order to provide the management with an accurate machine-cost calculation.

1.5 "InterI" – Commercial product and services in the 9th row of Table 1:

This firm got a new ERP system which provided information on the firm's receivables once a week. This had to be modified immediately, because the management needed daily information regarding the receivables due to their high value. In addition to the standard ERP reports, we developed a daily report on receivables for the management with help of a special direct cash flow record system.

1.6 "KT" – Textile products in the 4th row of Table 1:

During the bankruptcy procedure, the firm needed a new subsystem to track its obligations that were due in 14 days.

The examples above show some special Accounting Information Technology requirements of different firms. Below, we will summarize what one can generally know about AIT (Accounting Information Technology), and moreover, how we can develop information systems that meet the special demands of management.

2. Methodology from the Literature

2.1 Business and managerial characteristics of the firms and economic entities

Different enterprises (industrial, agricultural, service) have unique business and managerial characteristics, which also make their accounting information systems needs special, meaning that in the end, every company uses a unique accounting information system (Horngren 2008, Körmendi 2002, Rappaport 1986, Sinkovics 2010). Our research confirms the contents of the cited sources in that the specification of the optimal accounting system for firm depends on the following:

- 2.1.1 The field of operation of the economic entity or firm in question (industrial, agricultural, services, foundations, budgetary organizations, etc...)
- 2.1.2 Its size (turnover) and number of employees
- 2.1.3 Ownership (private, public, budgetary) and financing
- 2.1.4 Organizational culture
- 2.1.5 Managerial skills.

2.2 On Accounting Information Technology (AIT): Information systems contain data and algorithms (Neumann 1959). The ERP systems of firms contain the hard part of management and accounting information. Meaning that the accounting data and algorithms of the firms are integrated into the information system as on-line elements of the business intelligence. For studying the issues related to developing accounting information systems, and based on Table 1, *it is useful to divide accounting information technology (AIT) elements and functions into 3 separate groups: AIT-1, AIT-2 and AIT-3* (Mc Grow 1993, Fabricius-Ferke 2011):

2.2.1 AIT-1: General AIT elements and functions that are used in all companies. These functions are usually included in ERP systems as standard/well known solutions, or templates. Some examples include: creating invoices, online transaction processing, financial accounting, preparation of the accounts, etc...

2.2.2 AIT-2: Tested functions applied in a given group of firms/economic entities (the function being specifically needed by that group), for example: inventory management, FIFO or other stock value calculation, tracking the momentary financial situation of the firm, etc...

2.2.3 AIT-3: AIT functions and methods that are only needed at the given firm/economic entity, and are therefore unique and completely specific to that entity. Examples include: solutions for tracking clients' credit limit, calculating the cost of municipal services, and solutions for calculating the amortization of assets that are held for security and reserve purposes only, etc.... Integrated and online ERP systems do not provide the unique functions of AIT-3. This problem appears in 3 typical cases:

- The ERP system cannot answer the management's unique (data) requests. In this case it is necessary to design a new subsystem (like in case 1.4, "BH Industrial services"),
- A new system is introduced, but it cannot provide the appropriate data, or that data is wrong. In this case it is necessary to modify the system (like in case 1.5, "Inter-I Commercial product and services"),
- The management's information needs change faster than how the ERP system can be updated (like in the "KT textile products" case).

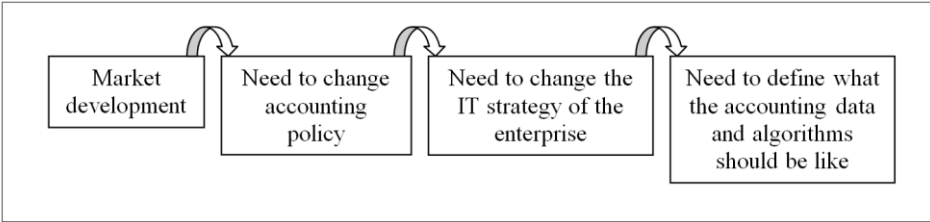
It is apparent that the economic entities can use the same software solution to cover their AIT-1 needs, while the required AIT-2 solutions vary between a few well-defined categories. All AIT-3 functions are unique, and therefore the solutions used by the companies have to be unique. AIT-3 covers the management accounting and controlling solutions that are related to tracking the MIS/OLAP manager reports, the most important strategic goals and KPI-s (Key Performance Indicator as defined by the management) of the entity. (Fabricius-Ferke 2011).

The term management accounting usually refers to monitoring and analysis of costs (Horngren 2008, Körmendi 2002, Sinkovics 2010, Fabricius 2011). Table 1 shows that the AIT-3 solutions were related to cost-sensitivity in case of 13 companies out of the 24. At the same time *the managerial accounting and controlling solutions have to be the defining, central parts of the whole accounting policy* of every firm and economic entity. The accounting structures and connections that fulfil the information need of managerial accounting are called "internal accounting" in the Hungarian accounting context. There are two interesting conjunctions: while the possible financial accounting rules of the firm depend on the laws of the country, *the solutions for managerial accounting questions only depend on the idiosyncrasies and specialties of the economic entity.*

In short: *AIT-3 includes the most specific, unique and interesting parts of an economic entity's business intelligence.*

2.3 The need to upgrade an accounting system: at the same time *the accounting policy of firms needs to be changed periodically, or at odd times.* The upgrade of an accounting system is always brought on by the company adapting to market developments, or by the changing business situation of the company. The new accounting policy demands some changes to the data and algorithms of the accounting system. Therefore, there is always a new optimal structure for our AIT system, and there must be an IT strategy to develop that new AIT system, see Fig 1 (Mc Grow 1993, Fabricius-Ferke 2011).

Fig 1: A logical way of data model (accounting data and algorithms) development for AIT systems



(Fabricius 2015:365, compiled by the author)

2.3.1 Built-in Data Structure, Data Model and Business Intelligence

The ERP systems contain modules and lots of database files within each module too. Moreover, the same file may belong under several modules at the same time. Files may be linked to one another through multiple data relations. Data relations are important variables (columns) of the database, establishing the *Data Structure* of the information system. Whenever a software runs on a computer, it finds data with the help of these relations to calculate the results. In other words, the *Data Model is developed and defined by the data itself, through the relations of the files and by the algorithms* (Mc Grow 1993). The kernel of accounting information technology (AIT) is: what economic results have to be calculated for managerial reports, with the help of what data-relations, and from what kind of data.

Mass data, without Data Structure, would essentially be nothing else but a large, meaningless body of matter. This implies that *Business Intelligence* consists not only of a large amount of data, but it also includes in itself the structure and the algorithms of the database.

2.4 The challenge of the need of new managerial information

What will happen if management would require new information from the ERP system? Is the existing AIT Data Model capable of producing the new information requested by the management? Figure 2 shows the simplified structure of an ERP system from the data structure's point of view, indicating the data relations necessary for new information queries (The structure depicts a generic example and is not based on any specific case).

Data relations providing the managerial lists are generated from the important variables, the master data of the databases. The above figure shows only the most important master data. Changes in the market situation, or in any other environmental

factor will trigger the emergence of new managerial needs, and hence the need for a new IT strategy. Accordingly, new search procedures and also new master data must be put into place. This also means that new columns must be introduced as master data, and based on them, new relations must be formed among the already existing files. If need there be, new data records may need to be introduced as well. At the same time, some of the old master data and data relations may become redundant. That is to say that as a consequence of changing expectations and needs, the Data Structure of the ERP system has to be adjusted and a (partially or completely) new Data Model needs to be created. This essentially means that the company's, or business entity's Business Intelligence needs to be adjusted and developed.

It follows from the content of the table and from section 1.3 that the AIT-3 information request is the *unique and special demand of the management*. It can be deduced from the model described in point no. 2. (AIT-1, 2, 3) that AIT-3 includes the most specific, unique and interesting parts of an economic entity's business intelligence. This can also be interpreted the following way: whenever a company or an economic entity is forced to modify its accounting policy and hence its IT strategy due to the changing economic conditions or the changing market competition, it will face the most complicated issues with management's AIT-3 related information requests.

2.5 Purchasing and/or introducing a new accounting information system

There are 3 basic ways to change or develop an accounting information system either in its entirety or an essential part of it: in-house development, purchase, and modification of a purchased application to suit needs of the given enterprise. The latter case is the most frequently used way of developing AIT systems. There is a big selection of ERP systems, it is easy for a company to purchase a new IT system. However, choosing the new system needs to be done carefully, bearing in mind the specialties of AIT-3.

Section 2.5 showed that the Data Structure of accounting information systems, and in particular the structure (or network) of important variables, or master data (the columns in the record database, e.g. product code, partner code, code of cost, etc...), requires the AIT software to be shaped to the company's accounting policy whenever the software is used in data registry functions and accounting.

Whenever we purchase an ERP system for our own company, we also purchase a Data Model. More precisely, we purchase the accounting policy defined by the AIT included in the ERP. *This is the basic rule of data models: if we purchase the ERP system, we also purchase a specific accounting policy.* (Fabricius, 2011). Taking into consideration section 2.2, it is useful to divide business intelligence into 3 separate groups, just as in the case of accounting information technology (AIT-1, AIT-2 and AIT-3). Whenever we purchase an ERP system, we are purchasing all the elements of it. As shown in Table 1, AIT-1 elements of Business Intelligence can be acquired together with the ERP system, and AIT-2 solutions can mostly be parameterized following the purchase. The essence of the hereby described problem is that the purchased ERP system cannot provide the company with ready-to-use AIT-3 specialties solutions which would suit the company that purchases the system. Even if the offered Business Intelligence solutions have already proved to be appropriate for another company, it is certain that with respect to the special AIT-3 solutions the purchased system will contain solutions that are not in line with the needs of the given company purchasing it.

Based on all of the above, we can state that if market conditions or the company's business situation change, the accounting policy of the company have to be changed

accordingly. However, the information system used to support the accounting policy is composed of different parts with different characteristics (AIT-1, -2 -3). *Therefore, when adjusting the ERP system to match the changed accounting policy, the different parts of the accounting information system have to be handled differently.*

3. Discussion

In figure 1, we showed the general logic of firms' IT development. The result of this development is a data model definition that is adequate for the new accounting policy – that is, adequate in light of market changes or a new business strategy (1.M). In case of a regular accounting information system upgrade, the above listed components mean that while we are working on the customization of the purchased software, we have to consider which IT solution fits which accounting policy, and (allowing for possible compromises), *which is the exact data model – accounting policy – that should be implemented?* Is it the data model used for reaching the firm's business goals (according the business strategy, 1.M), or the data model and accounting policy used so far (2.M)? Are we using it with the data model of the purchased ERP (3.M)? In the optimal case we are using the data model that matches our new business goals and accounting-information strategy (1.M).

To see clearly Fig 3, we need a model that approaches systems development from a unique perspective; one that encompasses the 3.M syndrome.

3. M Syndrome in Information Technology:

There are always 3 data models present during the design and development period of accounting information systems:

- 1.M: The data model of the accounting policy laid out by the IT Strategy of the company (hereafter: ITS)
- 2.M: The current data model used so far
- 3.M: The data model of the purchased or adopted information (sub-)system(s).

4. Conclusions

During the management of IT systems innovation and development, we have to be aware that there are 3 models present; and we also have to ask ourselves the following: out of the three directions of 3.M, in which does the chosen IT solution shift the accounting information system under development? If we are not careful with the roll-out of the ERP, only the small intersection of the three sets (1.M, 2.M and 3.M) will be utilizable in the new accounting system. It is prudent to attach two examples (4.1, 4.2) to the above reasoning. These examples will help understand the 3.M model, and show that the inappropriate handling of systems development affects different accounting functions to differing degrees.

4.1 In case of AIT systems operating with many templates (that is, well known and structured algorithms and/or data model solutions (Fabricius, 2011; Mc Grow, 1993), we can be sure that the pre-development program used the same models as the current one, and a new IT Strategy will not require new models. These system-parts include those of financial accounting, cash-desk management, and invoicing; these are clearly functions of the accounting system that fall into the AIT-1 or AIT-2 category.

4.2 It is less clear *whether the purchased accounting method will fit* (that is, whether data models will match) *in case of special functions* of our firm's AIT (AIT-3).

Purchasing an ERP system is the most problematic in case of management accounting and controlling issues; that is AIT-3 functions. Since these are the accounting areas where we can find the most company/institution specific characteristics (that is, special AIT solutions), they are the ones most threatened according to the framework of the 3.M syndrome. This is because *the purchased ERP system comes with its own data model, and therefore, it is made for one specific accounting policy. By buying this system we buy the accounting policy, but this received accounting policy will not be suitable for the specific management accounting and controlling needs of our own company.*

5. Overview of the 3.M in case of purchasing and introducing a complete software

Nowadays, in case of the innovation of a general ERP module based accounting system, the following data models/accounting policies are on the table:

5.1: **1.M:** This is the data model of our new, envisioned information system (according to our IT Strategy, hereafter referred to as ITS). If our implementation of the new IT system was done according to the recommendations of systems development methodologies such as SSADM (Mc Grow, 1993), then it must have been described and defined by our Requirement-Specification (Fabricius, 2011; Mc Grow, 1993). If this is not so, we are in a difficult situation, as our company's expectations about the new accounting information system do not even exist on paper, while it already has two other existing data models in place (2.M, 3.M). The first is 2.M, as old system functions are present even though we want to modify them, and secondly the system to be purchased is built on the chosen ERP system (3.M) – see some notes below.

5.2: **2.M:** This is the accounting policy that was used up to the present. We assume – and this is true for all accounting policies (data models) – that accounting tasks were partly done manually, and partly electronically. In general we can say that after implementing a new system, the ratio tasks carried out electronically will increase; however, we have to make sure that this actually benefits the management and the accounting staff.

5.3: **3.M:** The ERP system to be purchased (which hopefully has not yet been paid in the preparatory period) obviously has its own data model, and with it, the program will define a sort of accounting policy. Also must have been a data model which hopefully have been documented according to SSADM standards (Mc Grow, 1993). In connection with this, we should remember the following:

5.3.1 If there is no IT Strategy and Requirement-Specification (that is, our concept is not finalized) upon the purchase of the complete ERP system, we simply get the data model that is available, or the one used at former applications. This statement is also true in the form that for those accounting areas where we have concrete, definitive desires for the new accounting policy in the IT Strategy, implementation will be easier. For areas where we do not have these definitive needs, we are “lost”: the accounting policy that will prevail will be the one brought along with the program.

5.3.2 All ERP systems have flexibility: this allows for customization. However, this flexibility is to our benefit if and only we have the Requirement-Specification (which is based on the IT Strategy) to direct the customization. Optimally, this should be done before actually paying for the new ERP system.

5.3.3: The required customization is done by the software companies: if they have a version of the system with similar parameters, they will of course bring that to our company, as it is in their interest also that there only be a minimal amount of modification required. Obviously, this will facilitate customization efforts only if we can compare that particular software version to the needs that are defined by our Requirement-Specification, and they match.

5.3.4: We have mentioned that the risk of data models being incompatible is the highest in case of AIT-3, that is, special accounting fields such as Controlling and Managerial Accounting, as these solutions are the most diverse across companies. This problem manifests mostly in case of decision-supporting information systems, as well as in case of special fields as production or resource management.

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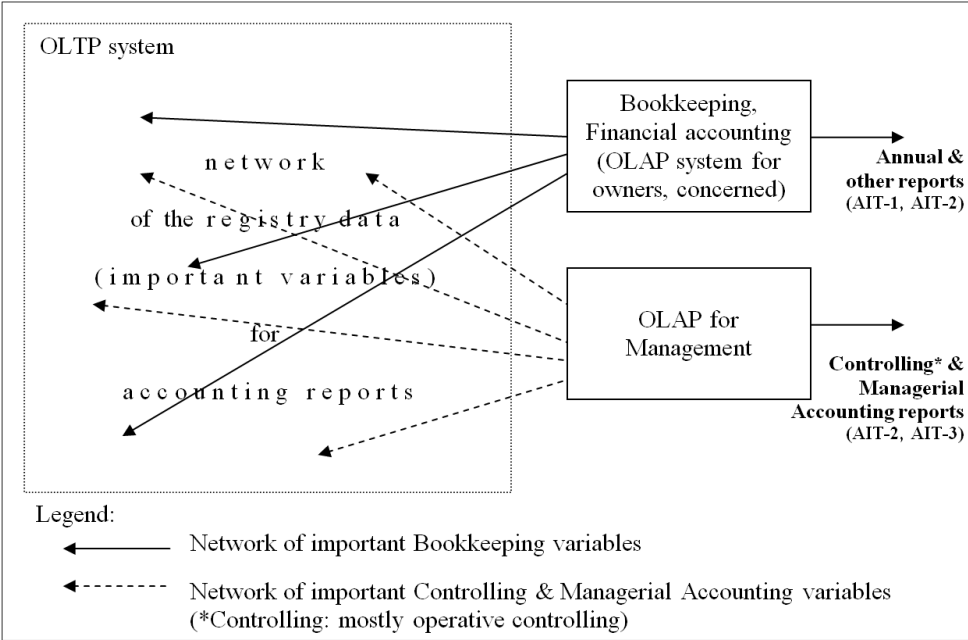
Appendix:

**Table 1: These are some real life examples of management information requests.
Out of the 24 companies in the table, 6 are large companies or subsidiaries
of multinationals and 9 are international firms**

<i>Sign</i>	<i>Fild of operation of the Company</i>	<i>Monitoring time period</i>	<i>Revenue (in 2014 HUF, million)</i>	<i>AIT-1 :bookkeeping functions done in house or outsourced?</i>	<i>AIT-2 : most important module of the ERP</i>	<i>AIT-3 : management unique request: all are VARIOUS</i>
PaP	H. Plastic products	1987-90	25 805	ERP - in-house	Production	Division level calculation of contribution, dynamic production planning
PiP	Z. Plastic products	1990-91	12 375	ERP - in-house	Production	Monitoring of production waste
HA	Metal products	1991-93	961	Outsourcing	Financials	Financial situation (CF)
KT	Textil products	1992-96	7 779	ERP - in-house	Financials	Managing the financial situation of the firm after bankruptcy
BT	A. Trade of construction materials	1994-96	6 990	ERP - in-house	Financials	Monitoring of receivables
SZ	Diary product	1994-95	4 431	ERP - in-house	Sales	Monitoring sales by market segments
PH	Trade in pharmaceuticals	1995-96	30 020	ERP - in-house	Inventories	Monitoring medicine inventories by expiry
BK	Food wholesale	1995-97	5 302	ERP - in-house	Sales	Monitoring key customers and helping to keep key customers
InterL	Commercial products and services	1997-2000	617	ERP - in-house	Financials	Monitoring of Receivables to ensure good cash flow
MuP	Ceramic product	1998-2000	10 625	ERP - in-house	Production	Monitoring of production costs
MiP	A. Plastic products	1999-2001	5 633	ERP - in-house	Production	Monitoring input usage and inventories in production
MB	B. Trade of construction materials	2000-2003	415	Outsourcing	Inventories	Managing stockpiles in accordance with customers' needs
OST	S. Industrial services	2000-2001	409	Outsourcing	Inventories	Managing inventories, utilizing old stocks
TK	C. Trade of construction materials	2001-2010	15 956	ERP - in-house	Financials	Monitoring customer credit limits (taking unpaid obligations into consideration)
KO	B. Plastic products	2003-2004	433	Outsourcing	Production	Labor utilization
BF	A. Industrial services	2001-2002	265	Outsourcing	Inventories	Availability of goods stockpiles
EV	Civil services	2003-2013	1 250	ERP - in-house	Machinery related services	Costs of municipal services
TT	D. Trade of construction materials	2007-2009	4 228	ERP - in-house	Sales	Sales margin of different products
BH	B. Industrial services	2007-2015	680	Outsourcing	Machinery related services	Accounting the amortization of machinery that is currently under-utilized (kept for spare capacity)
AT	Sped services	2010-2011	869	Outsourcing	Machinery related services	Project level and transport vehicle level profitability
DPA	Car services	2009-2011	311	Outsourcing	Machinery related services	Calculating the contribution of different operations
CA	Food products	2012-2014	838	Outsourcing	Production	Separating fixed and variable costs in production
AG	Car component products	2014-2015	31 715	ERP - in-house	Production	TQM statisits of production machinery
CO	C. Plastic products	2014-2015	17 500	ERP - in-house	Production	Calculating special production costs in case of continuous cost-cutting

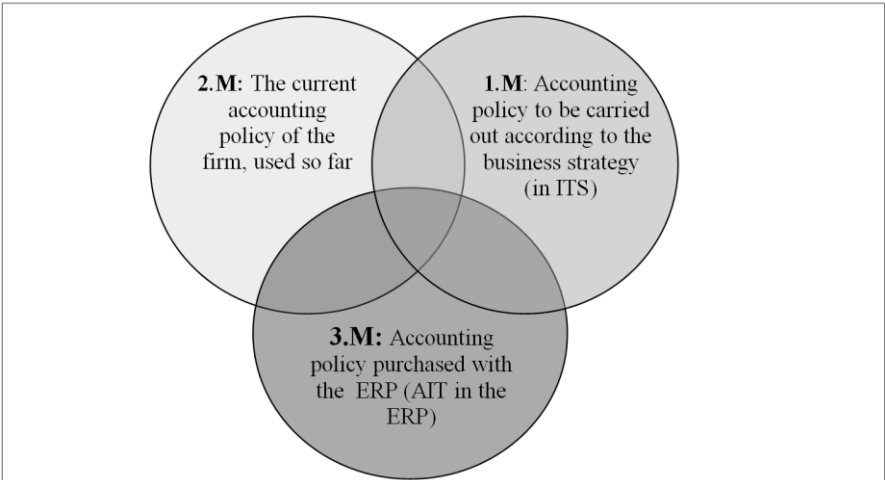
(Fabricius 2011:51)

Fig 2: Challenge in information needs require new or adjusted data structures within the ERP system



(Fabricius 2011:154, compiled by the author)

Fig 3: The 3.M Syndrome in introducing software systems is essentially a triple mind-split of accounting policies. If we are not careful, only the small intersection of the three sets will be utilizable in the new ERP system



(Fabricius 2011:336, compiled by the author)